BDAs et al.
A Brief Review of the Diversity of Restoration Structures
Outline

• Review: the ‘traditional’ Beaver Dam Analogue

• Variations on an old theme –
  • Post-less BDAs
  • Materials – working with what you’ve got

• High Density LWD
  • Post-Assisted Log Structures (PALS)
  • Selective Felling (seeding)
  • Grip-hoisting

• Zeedyk Structures
So you want to build BDAs...Why?

- There are many different types of structures used in stream restoration.

- Use watershed context, local geomorphic and hydrologic setting, riparian condition, and restoration goals to determine what structures are most appropriate.

- There isn’t only one right answer.
The ‘Traditional’ Beaver Dam Analogue

- Untreated wooden posts
- Willow weave
The ‘Traditional’ Beaver Dam Analogue

• Many examples in a range of settings

Natural Beaver Dams

What’s the difference?
To post or not to post?

• Site access

• Flow regime

• Geomorphic setting

What are the trade-offs?
Materials – Working with What You’ve Got

• Degraded riparian areas often lack woody riparian vegetation
• Upland vegetation (e.g., sagebrush, juniper) is often available
• When translocating beaver, leaving riparian species is essential
Materials - Working with What You’ve Got
High Density Large Woody Debris (HDLWD)

- Density over stability
- Strength in numbers
- Many types of structures – but focus on density!

Charley Creek treatment section and type of structures designed in 2013 (n = 208). Average distance between the structures ~ 20 m.
LWD - with Post-Assisted Log Structures (PALS)

- BDAs require more effort to build and maintain
- LWD can increase instream complexity and lateral connectivity
- Seeding – direct addition to the stream
- Selective felling

**Tools of the Trade**
- Chainsaw
- Griphoist
Zeedyk Structures

- Baffles
- Vanes
- Zuni bowls
- Rock rundown

Bringing it all Together - Birch Creek

- 2nd order stream in southern Utah
- Juniper encroachment
- Grazing
- Beaver eradication
- Limited riparian
- Low instream complexity
- Site of previous restoration (1970s)
Bringing it all Together - Birch Creek

- Numerous different structure types:
  - Primary BDAs
  - Secondary BDAs
  - Seeding
  - Debris Jams
  - Bank Attached Jams

- Structure type determined by reach-scale objectives and site specific characteristics
  - E.g. presence of side channel or accessible floodplain
Bringing it all Together - Birch Creek

- Primary BDAs increased channel-floodplain connectivity at baseflow (~0.4 cfs)
- Secondary BDAs increased pool habitat
- PALS designed to become geomorphically effective during high flows
- All structures increase instream roughness and promote increased lateral connectivity

Sub-surface re-entry point 150 m downstream
- Pre-restoration water extent
- Post-restoration surface water extent
Handbook of Erosion Control in Mountain Meadows. Published 1934
1. Numerous low dams along a gully are preferred to a few high dams. A "low" check dam is considered to be not over three or four feet in height. There is less danger of such structures washing out in time of flood, and if they should wash out less damage will result. Further, low dams are more economical than high dams.

2. It is more economical to reclaim a gully by stages, than to try to do it at one time or with one set of dams. The best method is to construct a series of low dams along the gully. When the catch-basins behind these dams have filled, another series of dams can be built on top of or just upstream from the original dams as illustrated in figure 17. One to three years will ordinarily elapse before it is necessary to construct a new set of dams, although occasionally one big storm may be sufficient to fill the catch-basins.

3. Temporary rather than permanent check dams are usually preferred. Once a gully has been reclaimed, and the erosion properly controlled by vegetation, the check dams serve no further purpose. It has also been found that temporary semi-pervious dams, consisting in part of brush, forest litter and other such material, are more effective in reclaiming gullies than more impervious dams. While the dams should be of a semi-pervious and temporary nature, leaving permanent control of the reclaimed meadow to be obtained by proper vegetative methods, it should not be assumed that dams need not be carefully designed and built.
Construction procedure

1. Slope back the banks, if too steep, as shown in figure 50. Throw the fresh dirt upstream from the dam.

2. Set posts of sound wood with 4-inch tops. The center posts should be long enough so that they can be buried 8 to 12 feet, and extend up to within one or two feet of the top of the gully bank. The outer posts need not be as deep but should extend higher as shown in figure 51. Space the posts 3 feet apart. Willow posts are recommended.

3. Set 3 to 4 stakes 3 inches in diameter and 3 feet long, as shown in figure 51. Use willow, if possible, and plant right side up so they will sprout.

4. Place a 6-inch layer of “litter” between the posts, and on the gully bottom and sides downstream from the posts for about 6 feet.

5. Place brush or green tree branches as shown in figures 52 to 54, inclusive. The long, straight limbs, “apron brush,” should be placed in a layer across the bottom. For the rest of the dam, the shorter “man brush” should be used. The butt ends should be placed upstream. Usually, the gully can be almost filled with brush and when the cross poles are placed, the brush will be forced down into a compact mass.

6. Place the cross poles on the upstream side of the posts. One or two can should stand on these poles to

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8. Place litter against the upstream face of the dam, as shown in figures 55 and 56.

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Nothing New Under the Sun - continued

The Development and Historic Use of Habitat Structures in Channel Restoration in the United States: The Grand Experiment in Fisheries Management

Douglas M. Thompson and Gregory N. Stull

Thompson and Stull, 2002
Figure 8.3A. Typical structures used in representative small- and medium-sized (4th and 6th order) streams, low gradient/sediment laden streams, and in bedrock streams (Crispin 1988).

Rehabilitating Stream Channels and Fish Habitat Using LWD

Slaney and Zaldokas, 1997
Figure 9-18. Examples of conceptual drawings of boulder-woody debris catchers, based on templates in lower gradient sections of the Quinsam River. Debris-trapping logs are a ramp spanning from the boulder attachments to the stream bottom.

Slaney and Zaldokas, 1997
Summary

• The structures you build depend on:
  • Restoration goals (including spatial extent!)
  • Resources
  • Recovery Potential
  • Watershed context
    • Geomorphic condition
    • Hydrology
    • Riparian condition
• Different structure types involve
  • trade-offs
• There isn’t one right answer